

299-W14-62 (A7346) Log Data Report

Borehole Information:

| | | | | | | |
|----------------------------------|---------------------|---------------------------------|---------------------------------------|-------------------------|--------------------------------|--|
| Borehole: A7346 | | | Site: 216-T-27 Crib | | | |
| Coordinates (WA St Plane) | | GWL¹ (ft): NA | GWL Date: 10/15/04 | | | |
| North (m) | West (m) | Drill Date | Ground Level Elevation (m) | Total Depth (ft) | Type Cable Tool | |
| 136,373.933 | 566,941.342 | 02/1983 | 206.024 | 68 | | |

Casing Information:

| Casing Type | Stickup (ft) | Outer Diameter (in.) | Inside Diameter (in.) | Thickness (in.) | Top (ft) | Bottom (ft) |
|--------------------|---------------------|-------------------------------------|--------------------------------------|----------------------------|-----------------|--------------------|
| Welded Steel | 2.85 | 8 5/8 | 8 | 5/16 | +2.85 | 68 |

Borehole Notes:

The logging engineer swabbed the borehole before logging. The swab was not above background. The logging engineer measured the stickup and inside and outside diameters of the casing using a steel tape. Logging data acquisition is referenced to the top of casing. Borehole coordinates were taken from the HEIS database. The drill date and depth information were found in *Hanford Wells* (Chamness and Merz 1993).

Spectral Gamma Logging System (SGLS) Equipment Information:

| | |
|---------------------------------|--|
| Logging System: Gamma 1E | Type: SGLS (70%) SN: 34TP40587A |
| Calibration Date: 10/04 | Calibration Reference: DOE-EM/GJ770-2004 |
| | Logging Procedure: MAC-HGLP 1.6.5, Rev. 0 |

High Rate Logging System (HRLS) Equipment Information:

| | |
|---------------------------------|--|
| Logging System: Gamma 1C | Type: HRLS SN: 39-A314 |
| Calibration Date: 05/04 | Calibration Reference: DOE-EM/GJ713-2004 |
| | Logging Procedure: MAC-HGLP 1.6.5, Rev. 0 |

Spectral Gamma Logging System (SGLS) Log Run Information:

| Log Run | 1 | 2 Repeat | | | |
|--------------------------|-------------------------|-------------------------|--|--|--|
| Date | 10/15/04 | 10/15/04 | | | |
| Logging Engineer | Spatz | Spatz | | | |
| Start Depth (ft) | 69.5 | 44.5 | | | |
| Finish Depth (ft) | 3.5 | 35.5 | | | |
| Count Time (sec) | 100 | 100 | | | |
| Live/Real | R | R | | | |
| Shield (Y/N) | N | N | | | |
| MSA Interval (ft) | 1.0 | 1.0 | | | |
| ft/min | N/A ² | N/A | | | |
| Pre-Verification | AE008CAB | AE008CAB | | | |
| Start File | AE008000 | AE008067 | | | |
| Finish File | AE008066 | AE008076 | | | |
| Post-Verification | AE008CAA | AE008CAA | | | |
| Depth Return Error (in.) | N/A | 0 | | | |
| Comments | No fine-gain adjustment | No fine-gain adjustment | | | |

High Rate Logging System (HRLS) Log Run Information:

| Log Run | 3 | 4 Repeat | | | |
|--------------------------|-------------------------|-------------------------|--|--|--|
| Date | 12/13/04 | 12/13/04 | | | |
| Logging Engineer | Spatz | Spatz | | | |
| Start Depth (ft) | 55.5 | 17.0 | | | |
| Finish Depth (ft) | 46.5 | 28.0 | | | |
| Count Time (sec) | 300 | 100 | | | |
| Live/Real | R | R | | | |
| Shield (Y/N) | N | N | | | |
| MSA Interval (ft) | 1.0 | 1.0 | | | |
| ft/min | N/A | N/A | | | |
| Pre-Verification | AC114CAB | AC114CAB | | | |
| Start File | AC115000 | AC115010 | | | |
| Finish File | AC115009 | AC115014 | | | |
| Post-Verification | AC115CAA | AC115CAA | | | |
| Depth Return Error (in.) | N/A | 0 | | | |
| Comments | No fine gain adjustment | No fine gain adjustment | | | |

Logging Operation Notes:

Logging was conducted on October 15, 2004 (log runs 1 and 2), and December 13, 2004 (log runs 3 and 4). Two logging systems were used. These systems are referred to as SGLS Gamma 1E (logs 1 and 2) and HRLS Gamma 1C (logs 3 and 4). Measurements were acquired with each system in a single casing string. Logging was conducted with a centralizer on each sonde. Measurements are referenced to the top of casing. Repeat sections were collected in this borehole for both systems to evaluate their performance. During log run 1, the sonde un-weighted at the bottom of the borehole at 69.7 ft.

Analysis Notes:

| | | | | | |
|-----------------|------|--------------|---------|-------------------|------------------------|
| Analyst: | Pope | Date: | 3/22/05 | Reference: | GJO-HGLP 1.6.3, Rev. 0 |
|-----------------|------|--------------|---------|-------------------|------------------------|

Pre-run and post-run verifications were performed for both logging systems. Acceptance criteria were met for both systems.

SGLS and HRLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G1EOct04_299-W1462.xls for the SGSL log, and G1CMay04_299-W14-62.xls for the HRLS log using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. Dead time corrections are applied where dead times exceed 6.4 and 10.8 percent for Gamma 1E and Gamma 1C, respectively. Where SGSL dead time exceeds 40 percent, HRLS data are substituted. A casing correction for 5/16-in.-thick casing was applied to the spectral log data (SGLS and HRLS). No correction for water was necessary.

Log Plot Notes:

Separate log plots are provided for the man-made radionuclides (^{137}Cs , ^{60}Co , and ^{154}Eu) detected in the borehole, naturally occurring radionuclides (^{40}K , ^{238}U , ^{232}Th [KUT]), and a combination of man-made, KUT, and total gamma plotted with dead time. Log plots for the man-made radionuclides (^{137}Cs , ^{60}Co , ^{152}Eu , and ^{154}Eu) are also provided comparing the current spectral data with the results of a 1992 Radionuclide Logging System (RLS) survey. The depths of the RLS data were adjusted down 3 ft to match the current SGSL data. The need for a depth correction is probably a result of differing zero-depth references. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, casing corrections, or water corrections. Repeat log sections are also included where appropriate.

Results and Interpretations:

^{137}Cs was detected in this borehole from ground surface and 12.5 ft (0.2 to 1.0 pCi/g), from 28.5 to 39.5 ft (0.2 to 330 pCi/g, peak at 30.5 ft), and from 43.5 to the bottom of the borehole. A zone of very high ^{137}Cs concentration was identified between 47.5 and 54.5 ft, through which the SGSL dead time was greater than 40%. The maximum concentration was 1312 pCi/g at 51.5 ft.

^{60}Co was detected from 29.5 to 46.5 ft (0.1 to 0.7 pCi/g, maximum at 37.5 ft), and in broken intervals from 56.5 to 64.5 ft (0.1 to 0.2 pCi/g, maximum at 59.5 ft). ^{60}Co is likely present between 46.5 and 56.5 ft, but is undetectable because of the high concentrations of ^{137}Cs over this interval.

^{154}Eu was detected from 29.5 to 31.5 ft (0.3 to 1.0 pCi/g), and from 36.5 ft to the bottom of the borehole ranging in concentration from 0.5 to 71 pCi/g. Concentrations peaked at 47.5 ft (71 pCi/g), 61.5 ft (27 pCi/g), and 66.5 ft (63 pCi/g).

^{152}Eu was identified during the 1992 RLS survey intermittently from 60.0 to 67.5 ft (adjusted depths), with concentrations ranging from 0.3 to 1.8 pCi/g (decayed to October 15, 2004). ^{152}Eu was identified at 61.5 and 66.5 ft during the current SGSL survey at concentrations of 0.6 and 1.0 pCi/g, respectively. The ^{152}Eu has presumably decayed below the MDL (around 0.4 to 0.5 pCi/g) elsewhere.

Concentrations of naturally occurring ^{40}K increase by an approximate factor of 1.5 at about 31.5 ft, which is coincident with an approximately equal increase in natural ^{232}Th concentrations. A logical interpretation would be that the clay content of the formation increases at these depths.

The 1992 RLS logs and the current SGLS logs are largely comparable for the man-made radioisotopes, exhibiting very similar character and structure. The repeat sections for the SGLS and HRLS indicate good agreement.

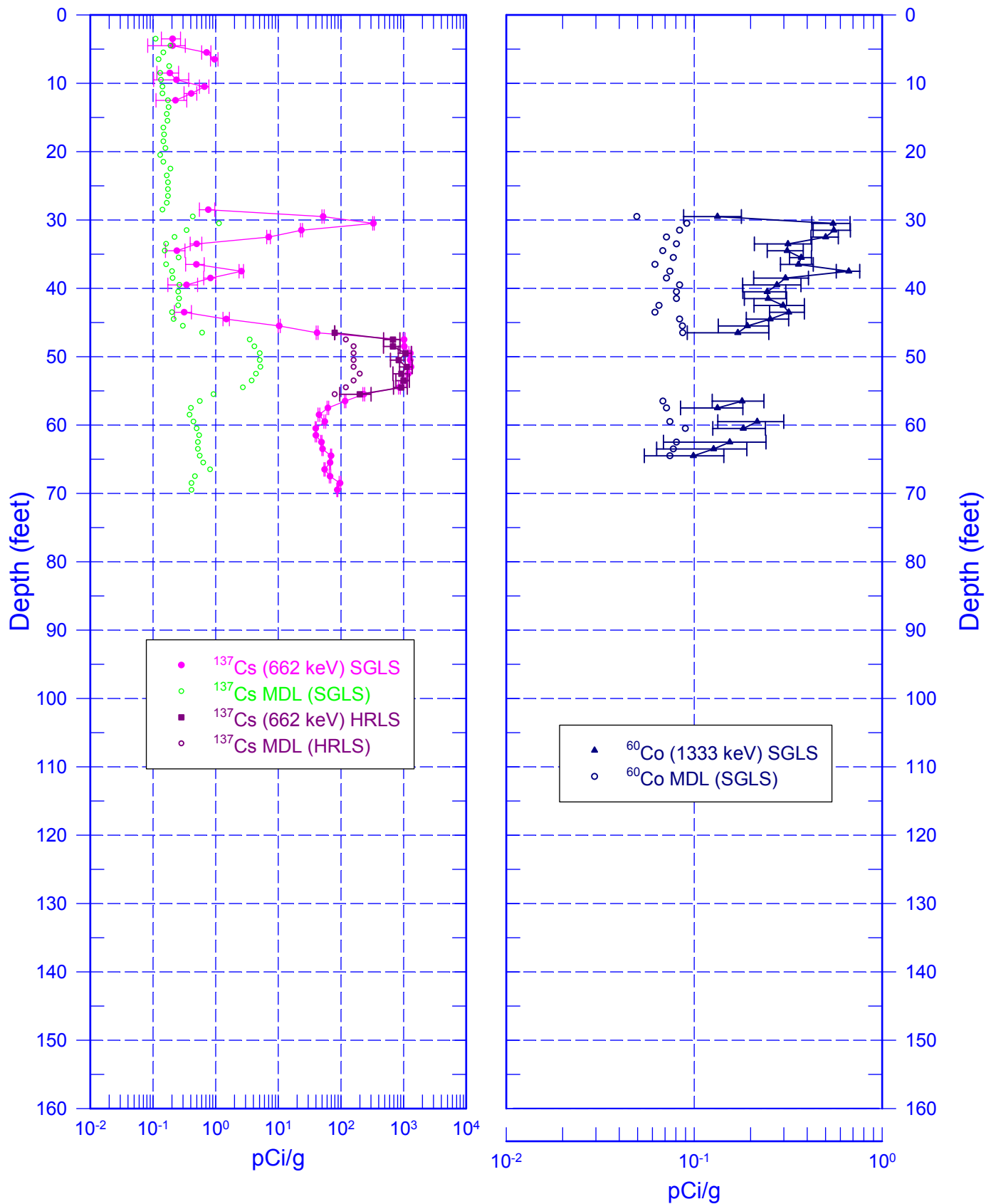
References:

Chamness, M.A., and J.K. Merz, 1993. *Hanford Wells*, PNL-8800, Pacific Northwest Laboratory, Richland, Washington.

¹ GWL – groundwater level

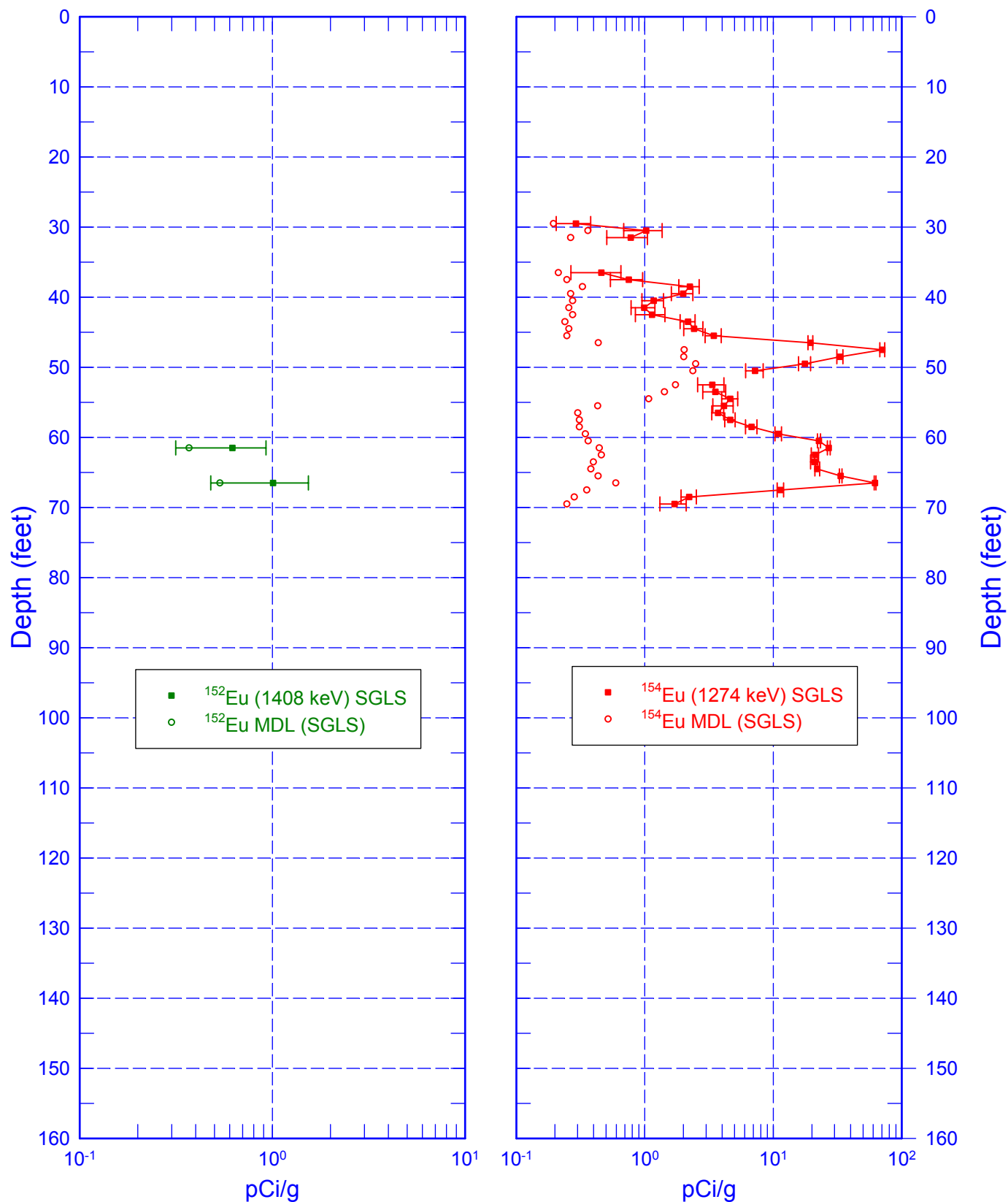
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Man-Made Radionuclides (^{137}Cs and ^{60}Co)



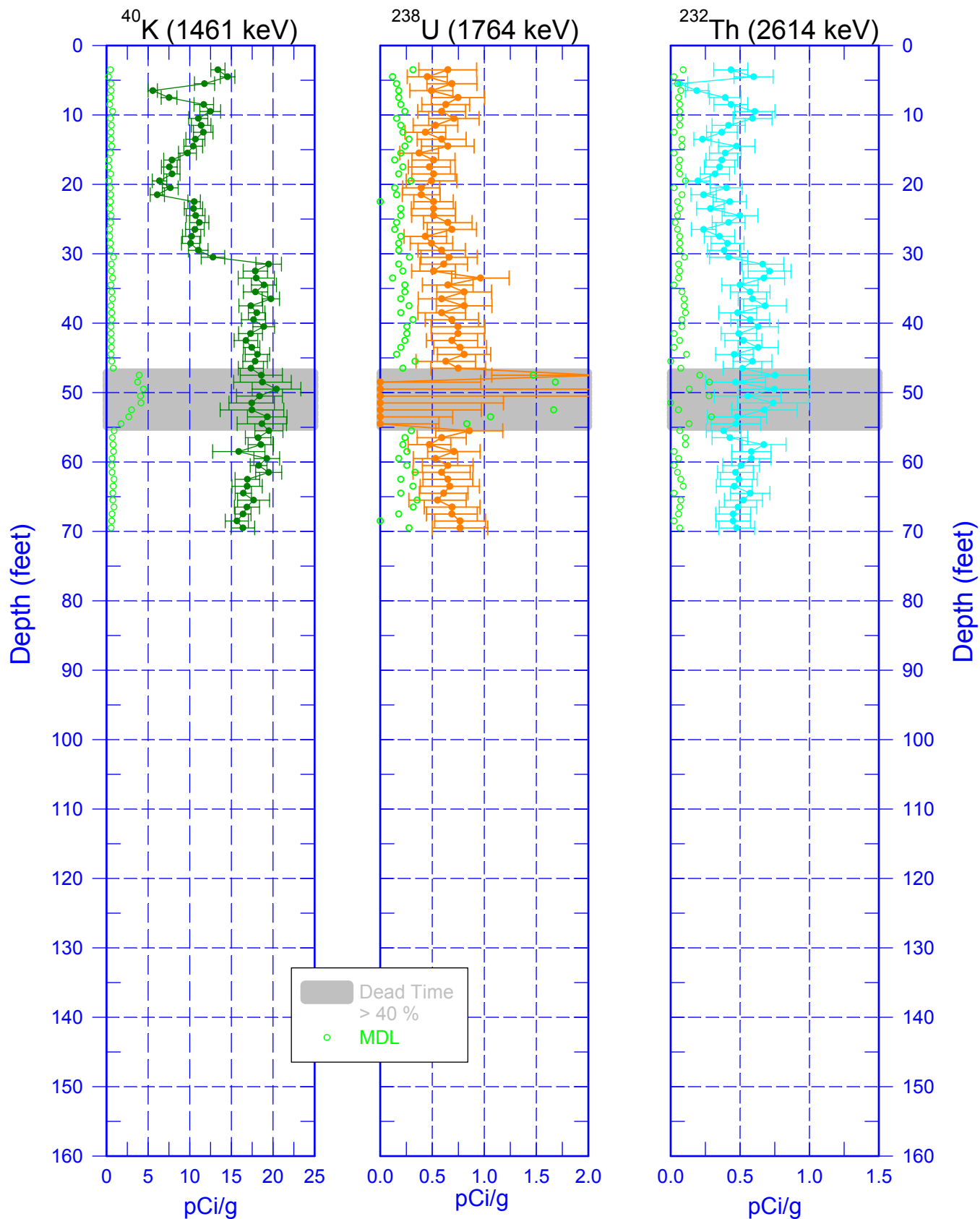
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Man-Made Radionuclides (^{152}Eu and ^{154}Eu)



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Natural Gamma Logs

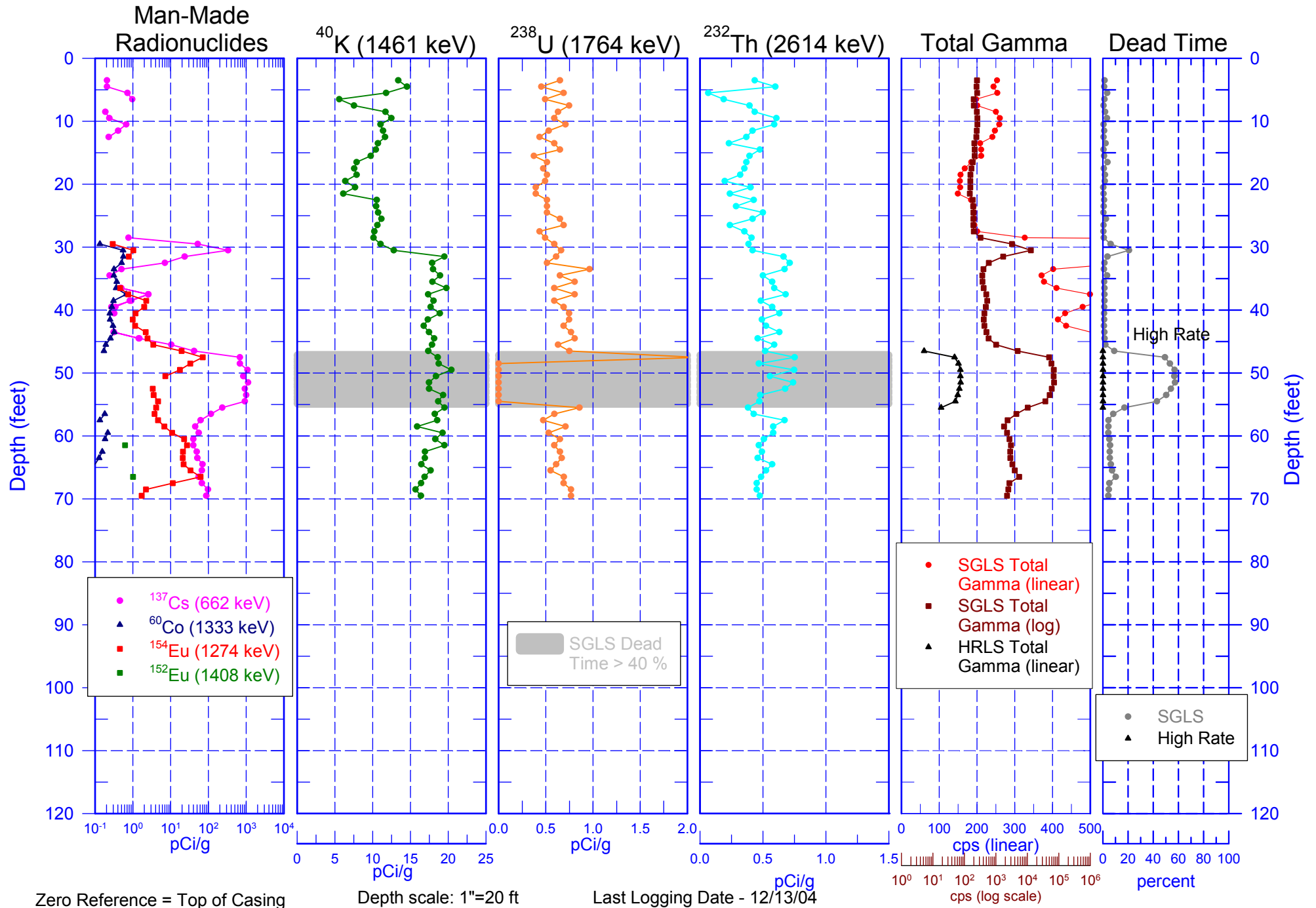


Zero Reference = Top of Casing

Depth Scale = 1" = 20 ft

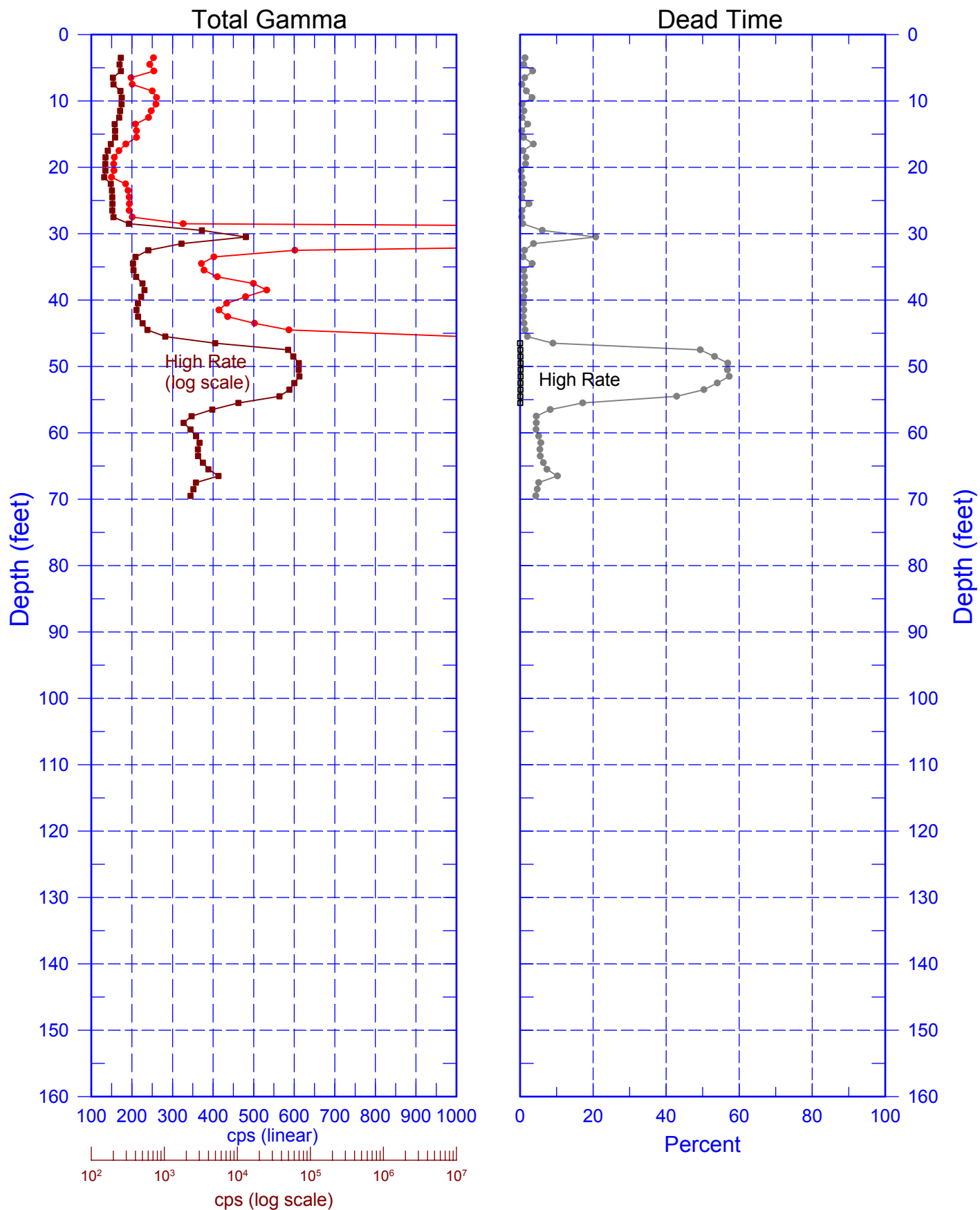
Last Log Date - 12/13/04

299-W14-62 Combination Plot



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Total Gamma & Dead Time



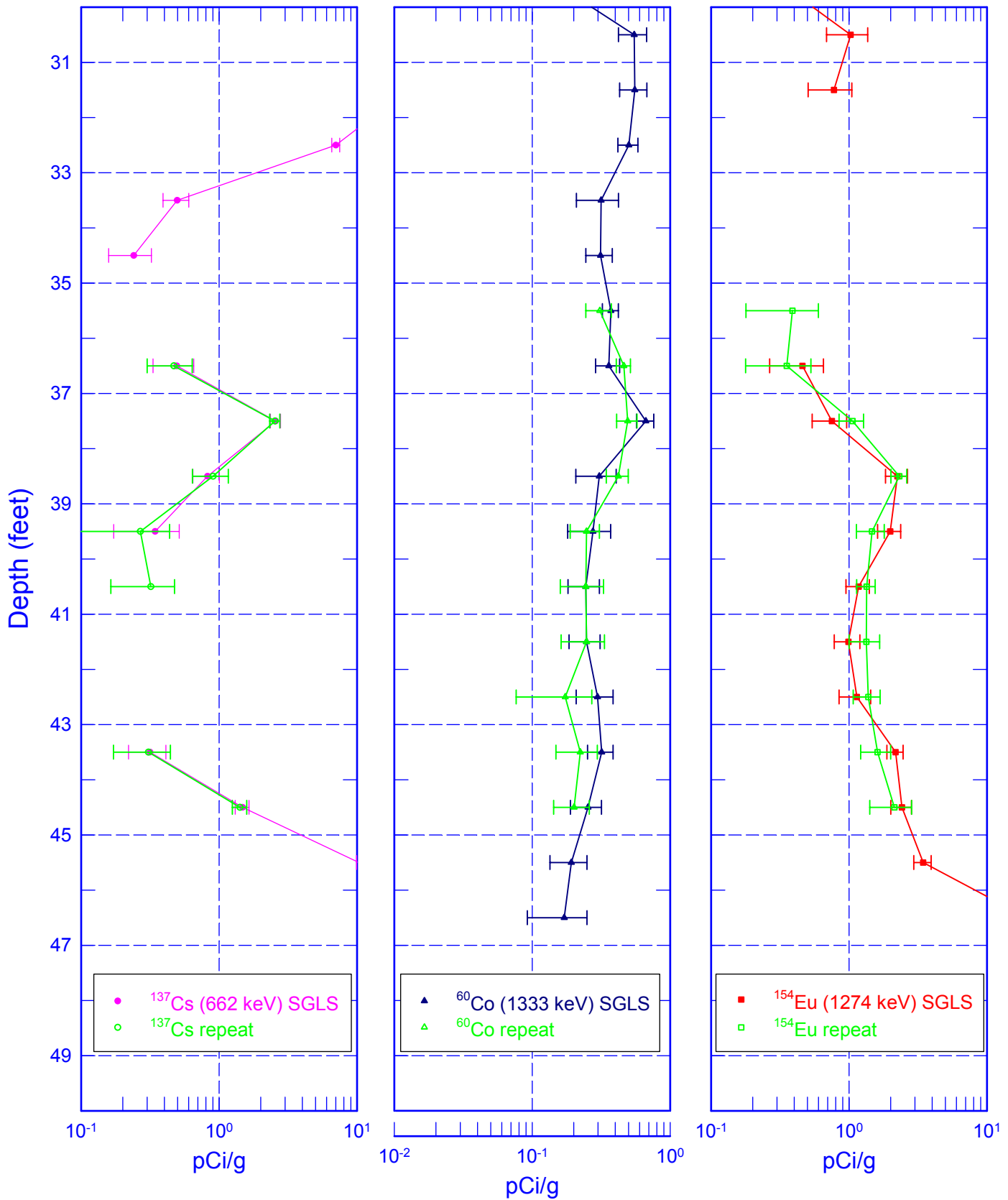
Depth scale: 1"=20 ft

Reference - Top of Casing

Last Log Date - 12/13/04

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SGLS Man-Made Repeat Data

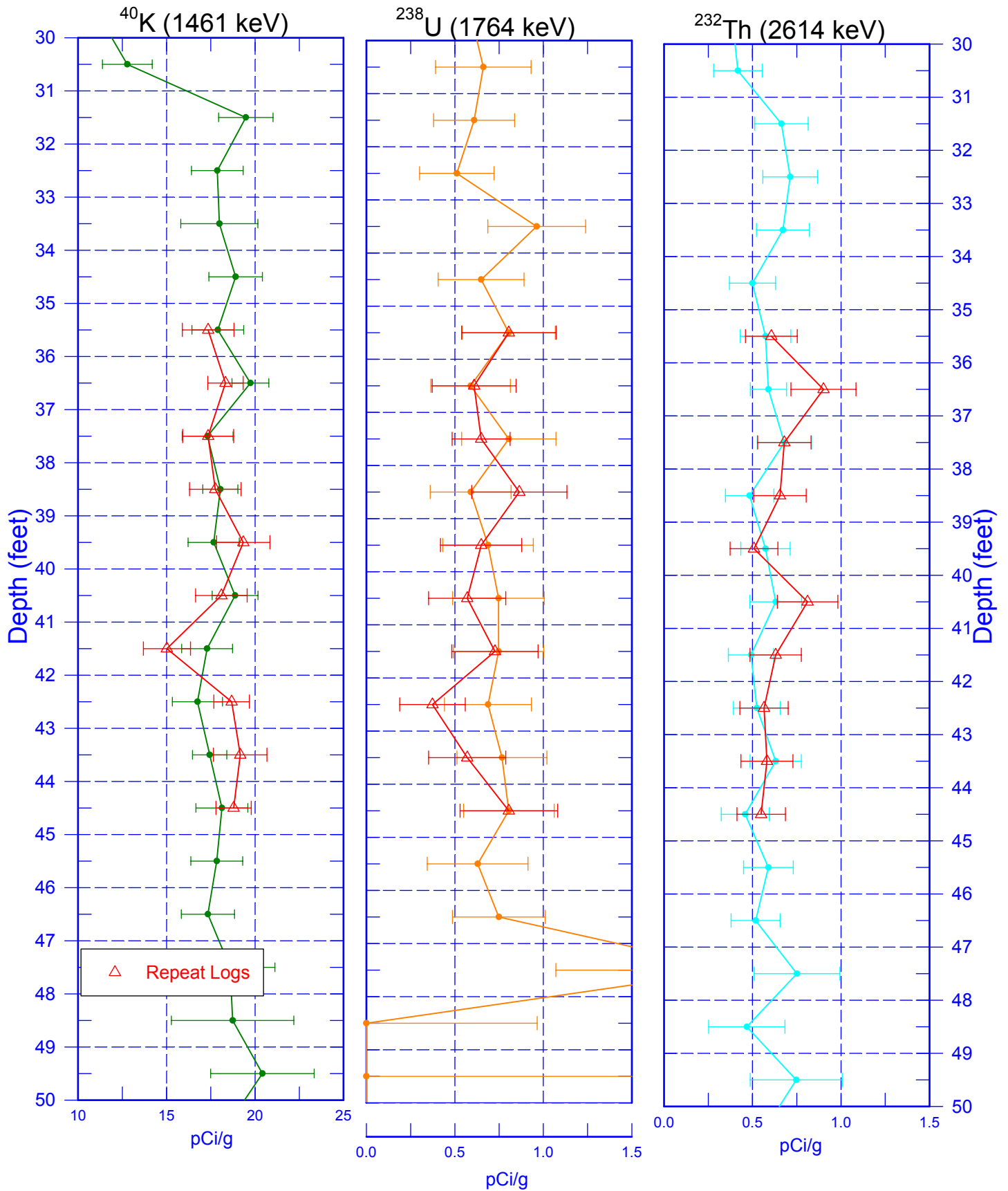


Zero Reference = Top of Casing

Last Log Date - 12/13/04

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Repeat Section of Natural Gamma Logs

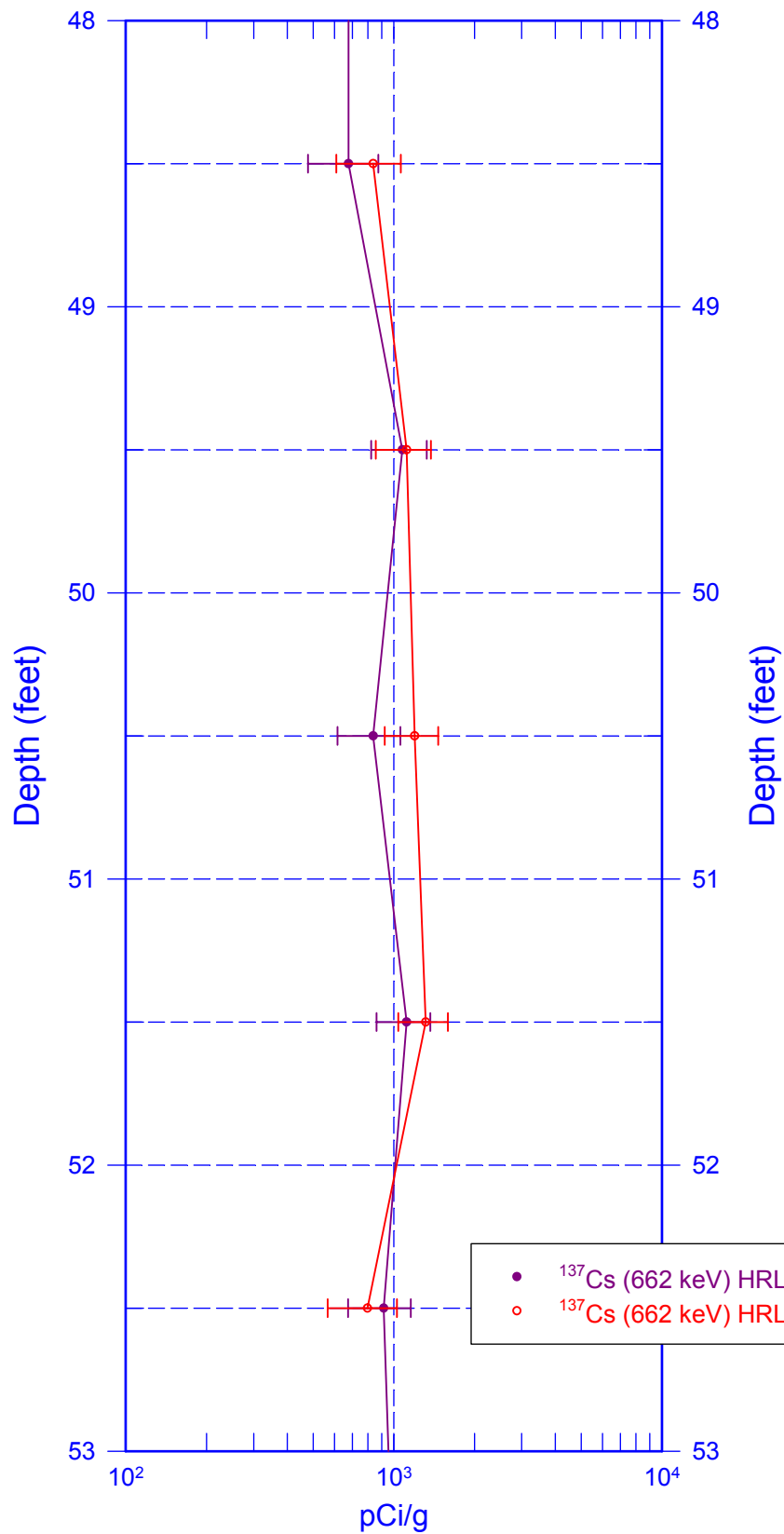


Zero Reference = Top of Casing

Last Log Date - 12/13/04

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¹³⁷Cs High Rate Repeat Section



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Man-Made Radionuclide Comparison

